TECHNICAL REPORT 2004-021

Single Integrated Air Picture (SIAP) Combined Joint Task Force Exercise 2004-2 (CJTFEX 04-2) Test Plan

MAY 2004

Joint Single Integrated Air Picture
System Engineering Organization (JSSEO)

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SIAP CJTFEX 04-2 TEST PLAN

Joint Single Integrated Air Picture (SIAP)
System Engineering Organization (JSSEO)

Reviewed By:

Signature by the reviewer indicates that his organization agrees to its role in the test event as described in the Test Plan.

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EXECUTIVE SUMMARY

INTRODUCTION

This document is the product of a collaborative effort between members of the Single Integrated Air Picture (SIAP) Analysis Team (SAT) that includes representatives from the Joint SIAP System Engineering Organization (JSSEO), US Joint Forces Command (USJFCOM), Service engineering experts, the Joint Combat Identification Evaluation Team (JCIET), and the Joint Interoperability Test Command (JITC). The purpose of this document is to provide an overview of the planned activities to be performed by this collaborative team at the Combined Joint Task Force Exercise 2004-2 (CJTFEX 04-2). These activities include:

- Fulfilling the USJFCOM Technical Tasks of assessing the SIAP and conducting root cause analysis in support of that assessment
- Conducting critical experiments in support of the development and testing of the Integrated Architecture Behavior Model (IABM)
- Using this exercise to continue Joint certification assessment proof of process.

BACKGROUND

In June 2004, USJFCOM will conduct Phase III of the Combined Joint Task Force Exercise (CJTFEX) 04-2 on the East Coast. This event, being led by the Navy's 2nd Fleet, will integrate forces from the Navy, Marine Corps, Army, Air Force, and multinational partners.

Real world events have underscored Joint Combat Identification (JCID) challenges, highlighting the need to continue JCID assessment. The primary purpose of CJTFEX 04-2 is to provide a Joint training venue and at the same time support USJFCOM Joint National Training Center (JNTC) assessment, JNTC instrumentation development, and JCIET JCID evaluation objectives. Technical Concept Demonstrations (TCDs) (e.g., Office of the Secretary of Defense/ Joint Methodology to Assess C4ISR Architecture (JMACA), Air Force Research Laboratory's (AFRL) Targets Under Trees (TUT)), Service test agencies (e.g., TEMP 801), and Joint Test and Evaluations (JT&E) (e.g., Joint Global Positioning System Combat Effectiveness (JGPSCE)) also plan to conduct critical FY04 incremental testing and concept development. USJFCOM will design CJTFEX 04-2 based on proven methods of instrumenting all participants, capturing truth data, and conducting in-depth participant debriefs.

Commander, US Joint Forces Command, established the evaluation of the SIAP as a technical objective for the event. The SAT will conduct both on-site and post-event analysis to fulfill this objective.

ISSUES

Integrated Air Defense System (IADS) performance and Joint Data Network (JDN) assessments must be conducted to determine what systems need improvements. Evaluation of the air picture at live exercises/events is critical for identifying problems and developing and testing solutions to air picture deficiencies.

SCOPE

This document describes the overall objectives, defines critical experiments, and assigns the schedule. It also provides JSSEO's roles and responsibilities and those of the organizations affiliated with JSSEO, including JCIET, JITC, USJFCOM, and the Services. The SIAP Test Readiness Report (TRR) will update this Test Plan and be presented at the Test Readiness Review in May 2004. The Test Readiness Report will include the data management and analysis plan (DMAP), a description of the on-site SAT activities and logistics.

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1. INTRODUCTION

This document is the product of a collaborative effort between members of the Single Integrated Air Picture (SIAP) Analysis Team (SAT) that includes representatives from the Joint SIAP System Engineering Organization (JSSEO), US Joint Forces Command (USJFCOM), Service engineering experts, the Joint Combat Identification Evaluation Team (JCIET), and the Joint Interoperability Test Command (JITC). The purpose of this document is to provide an overview of the planned activities to be performed by this collaborative team at the Combined Joint Task Force Exercise 2004-2 (CJTFEX 04-2). These activities include:

- Fulfilling the USJFCOM Technical Tasks of assessing the SIAP and conducting root cause analysis in support of that assessment
- Conducting critical experiments in support of the development and testing of the Integrated Architecture Behavior Model (IABM)
- Using this exercise to continue Joint certification assessment proof of process.

1.1 Background

In June 2004, USJFCOM will conduct Combined Joint Task Force Exercise (CJTFEX) 04-2 on the East Coast. This event, being led by the Navy's 2nd Fleet, will integrate forces from the Navy, Marine Corps, Army, Air Force, and multinational partners.

The primary purpose of CJTFEX 04-2 Phase III includes:

- Certify the Carrier Strike Group (CSG) and Expeditionary Strike Group /Marine Expeditionary Unit (ESG / MEU) Special Operations Capable (SOC) for deployment

- Use CJTFEX 04-2 as an enhanced integration exercise to facilitate the establishment of JNTC initial operational capability by October 2004

- Conduct interoperability training employing a forcible entry operational scenario

- Integrate, train and assess USJFCOM component and multinational forces in selected Joint Tactical Tasks (JTTs)

- Provide venue for combat identification and interoperability evaluation, TTP assessment, Technology Concept Demonstration (TCD) and Joint Test and Evaluation (JT&E)

- Provide a venue for US / UK bilateral training and Australia, Britain, Canada, America exercise.

Real world events have underscored Joint Combat Identification (JCID) challenges, highlighting the need to continue JCID assessment. The primary purpose of CJTFEX 04-2 is to provide a Joint training venue for the warfighter and at the same time support USJFCOM Joint National Training Center (JNTC) assessment of component forces in selected joint tactical tasks, JNTC instrumentation development, and JCIET JCID evaluation objectives. Technical Concept Demonstrations (TCDs) (e.g., Office of the Secretary of Defense/ Joint Methodology to Assess C4ISR Architecture (JMACA), Air Force Research Laboratory's (AFRL) Targets Under Trees (TUT)), Service test agencies (e.g., TEMP 801), and Joint Test and Evaluations (JT&E) (e.g., Joint Global Positioning System Combat Effectiveness (JGPSCE)) also plan to conduct critical FY04 incremental testing and concept development. USJFCOM will design CJTFEX 04-2 based on proven methods of instrumenting all participants, capturing truth data, and conducting in-depth participant debriefs.

Commander, US Joint Forces Command, established the evaluation of the SIAP as a technical objective for the event. The SAT will conduct both on-site and post-event analysis to fulfill this objective.

1.2 Purpose of SAT Involvement in this Test

The purpose of SAT involvement in the CJTFEX 04-2 exercise is two-fold. First, the SAT will assess the SIAP and identify SIAP-related issues that impact today's warfighter in support of the USJFCOM technical objectives. Second, the SAT will support critical experiments that JSSEO will conduct in support of development and testing of the Integrated Architecture Behavior Model (IABM) and the Joint Distributed Engineering Plan (JDEP) Technical Framework.

1.3 Scope of SAT Involvement in this Test

The overall scope of SAT involvement for CJTFEX 04-2 is as follows:

1) Conduct SIAP Assessment
   - Assess the SIAP using the SIAP attributes
   - Identify root causes and contributing factors to correct interoperability deficiencies.
   - Use assessments to further develop/refine key performance requirements published in JROC-validated Capstone Requirements Documents.

2) Conduct Critical Experiments

- Assess accuracy of Precise Participant Location and Identification (PPLI) of Rivet Joint
- Conduct Sensor Data Registration Algorithm (SDRA) data registration test with PATRIOT
- Conduct Correlation/Decorrelation Interface Change Proposal (ICP) test with United Kingdom (UK) Airborne Warning and Control System (AWACS) and Tactical Air Operations Module (TAOM)
- Assess network latency
- Support verification of JDEP test environment and future PSM sensor services
- Measure mobility rate.

3) Conduct Multi-Source Integrator (MSI) capability demonstration (limited SAT participation)
   - Refine MSI MOPs using coherent set of data from multiple sensors collected during exercise
   - Provide venue for industry to demonstrate MSI capability.

4) Conduct JITC Proof of Concept

5) Baseline Information Exchange Assessment

2. OVERALL TEST DESIGN

2.1 Concept of Test Operations

This section describes the SAT assessment of the SIAP, the conduct of the critical experiments, the MSI capability demonstration, and JITC assessments, specifically, track quality assessment and network baseline assessment. Data requirements, data collection teams, and analysis methods are discussed for each activity.

During the event, efforts will be focused on the air defense vulnerability ("vul") period scheduled from 1200-1700 daily 12-21 June 2004. This analysis window has been established to support the exercise technical objectives. During this period, all participating aircraft will be instrumented with Global Positioning System (GPS)-based Time Space Positioning Information (TSPI) collection equipment. GPS jamming operations during this window will be prohibited in the air defense area of operations. Additionally, specific aircraft profiles will be flown during this time, and specific equipment and computer program configurations necessary to support the technical objectives will be set during this time.

2.2 SIAP Assessment

To assess the SIAP as directed by USJFCOM, exercise units need to interoperate in a manner that allows them to correlate tracks, appropriately exchange reporting responsibility, and maintain mutual supporting tracks on tactically significant TSPI-equipped aircraft (both those with and without PPLI). The SAT will conduct track to truth matching in order to calculate the SIAP attributes as defined in Technical Report (TR) 2003-029, and conduct root cause analysis of observed air picture deficiencies identified from the exercise. The Center for Naval Analyses (CNA) will conduct track matching and SIAP attribute calculation with assistance from the SIAP Analysis Team. Air picture deficiencies and other observed events of interest will be documented for post-event root cause analysis by the SAT in conjunction with the Navy's TEMP 801 evaluation effort.

2.3 Precise Position Location Information (PPLI) Accuracy

2.3.1 Experiment Objective

Evaluate the accuracy of PPLI reports reported by Rivet Joint and determine its impact on sensor registration and correlation/decorrelation performance.

2.3.2 Experiment Hypothesis

The Military Standard (MIL-STD) 6016C correlation/decorrelation process and proposed data registration process utilize PPLI link message reports to perform correlation/decorrelation calculations and correct for sensor registration biases. Previous analysis indicates that PPLI reporting accuracy is inconsistent. It is hypothesized that some link participants have host/terminal navigation integration errors that affect the Geodetic Position Quality (GPQ) in its reported PPLI, and this uncertainty has unexpected consequences which may need correction.

2.3.3 MOPs and Attributes Measured

There are no MOPs measured for this critical experiment. Kinematic accuracy is the primary SIAP attribute expected to be affected for this experiment.

2.3.4 Data Management and Success Criteria

The data collection requirements for this critical experiment include the following:

- Time tagged ground truth WGS-84 positional data (@ ~ 1 Hz) (WGS-84 altitude is with respect to Mean-Sea-Level (MSL))
- Uncertainty in accuracy of ground truth WGS-84 positional data for unit PPLI (if available)
- PPLIs from the units of interest from Link-16 received messages
- Link-16 navigation Terminal Input Messages (TIMs)
- Link-16 navigation Terminal Output Messages (TOMs)

PPLIs for the unit being evaluated may be recorded by any Terminal within line-of-sight connectivity of the platform. The unit terminal TIMS and TOMS must be recorded at the unit via MUX tape recording or Terminal Support Port Tape Recording (for Rivet Joint, TIMS 7&8 and TOM 1 are the desired parameters).

The success criteria for this experiment include sixty minutes or more of on-board GPS data, corresponding J2.2 messages, and corresponding truth data. A reasonable quantity of data will be collected to provide confidence that enough data will be available for post-event analysis. The Rivet Joint operator will verify proper data extraction (DX) equipment, and a chain of custody control.

2.3.5 Test Methodology

Determine and document the exact data elements that must be provided to JTIDS terminals from the host system in order to produce an accurate PPLI. Establish threshold GPQ requirements.

2.3.6 Requisites

Requisites for this experiment include Link-16 air and surface/ground participants capable of transmitting PPLI reports, Link-16 network monitoring, and recording. For fighter/attack aircraft TSPI data, real-time telemetry or pod data recording for post-event analysis is required.

This critical experiment focuses on the PPLI accuracy validation of the Rivet Joint aircraft. Currently, the Rivet Joint aircraft will not carry location instrumentation pods. JSSEO has submitted a request and a draft Memorandum of Agreement (MOA) for time-tagged GPS inputs from the onboard navigation system at one-second intervals as a reasonable surrogate for a location instrumentation pod. Operational issues will be coordinated with the AF 55th Wing once the MOA is signed.

A specific operational context is not required for study of this issue.

2.3.7 Data Reduction and Analysis Method

Data shall be in American Standard Code for Information Interchange (ASCII) text format.

The analysis method includes the following steps:

1) TSPI and Link data collections will be conducted by Mr. Jim Ferrell, WBB, Inc., by means of a Link data recorder and an LMS-16.
2) Data shall be in ASCII text format. If not, the Service Subject Matter Experts (SMEs) shall convert their system's code to ASCII files for post analysis.
3) Measure the reported PPLI position as reported in the J2.2 message compared to ground truth.

2.3.8 Analysis Team

The analysis team for this experiment is lead by Mr. Steve Beck, JSSEO/WBB, Inc. The SIAP core team analyst is Mr. Wayne Altrichter, BAE Systems. Mr. Jim Ferrell will provide data collection assistance.

2.3.9 Reporting Schedule

The analysis team will provide a Rivet Joint PPLI accuracy report. A quick-look report will be provided to the JSSEO within thirty working days of the end of the CJTFEX 04-2 event. The final analysis report will be provided to JSSEO within 90 days after the required truth and system data is available to the analysis team.

2.4 Sensor Data Registration Algorithm (SDRA)

2.4.1 Experiment Objectives

Evaluate the Sensor Data Registration Algorithm's (SDRA) ability to estimate and "correct" sensor measurement and mis-alignment errors in a live environment.

2.4.2 Experiment Hypothesis

It is hypothesized that uncompensated data registration errors have an adverse impact on the SIAP. These errors impact the weapon system's ability to determine track accuracy and subsequently induce inaccurate track quality (TQ) values. The SDRA will help eliminate dual tracks caused by data registration alignment errors and is a good candidate for data registration functionality for the Integrated Architecture Behavior Model (IABM). Specifically, SDRA will improve PATRIOT sensor registration and PPLI geodetically registered objects.

2.4.3 MOPs and Attributes Measured

The following MOPs support determination of weapon system(s) performance relative to Data Registration (DR) analysis:

1) Local frame of reference, converted to a common absolute frame of reference, defined by the WGS-84 ellipsoid earth model.

2) Data Registration e.g., Global track file
   - Navigation Registration
   - Sensor Registration

3) Target Accuracy
   - Reported Track Quality (TQ)

4) Four data sources will be compared against truth:
   - Navigation data
   - Sensor data
   - Command and Control (C2) track file data

– Reported communication network data (Link 16 J3.2 message)

The analysis will quantify the biases associated with the air object as it is processed internally (locally) and remotely throughout the SIAP communication network.

Kinematic accuracy and clarity are the primary SIAP Attributes expected to be impacted by the SDRA experiment.

2.4.4 Data Management and Success Criteria

The data required to conduct analysis for this critical experiment include:

- Ground-truth data
- Data link recording and raw system data (including navigation data)
- PATRIOT System data
- Initialization data in lieu of geodetic survey data for ground based sensors and antennas
- Uncertainty in accuracy of unit positional data from the ground truth
- Time-tagged measurement data on the position of the ground truth from sensor detection
- Uncertainty of sensor measurement
- Navigational data of the PRP, WGS-84 position of Platform Reference Point (PRP). WGS-84 velocity of PRP, i.e., local level ENU velocity vector.
- Attitude vector of PRP orientation relative to East North Up (ENU) local level, i.e., roll, pitch, and heading data. Rate of change of attitude vector of PRP, i.e., roll rate, pitch rate, and heading rate.
- Lever arms from PRP to center of sensor, aperture and lever-arm between navigation system and PRP (if non-zero)
- Surveyed orientation of sensor frame with respect to local level body coordinates of the platform reference frame of PRP. *WGS-84 Altitude is with respect to Mean-Sea-Level (MSL).

NOTE: The PRP may be coincident with the origin of the primary navigation system, where the primary navigation system is defined as the one used for track generation. If a platform has dual navigation systems, then data should be recorded for both, along with an indication of which one is being used for track determination.

The following are the success criteria for this critical experiment:

- Quantify the weapon systems' ability to correctly compensate for navigation and sensor position and misalignment errors.
- Document the impact of uncompensated data registration errors on the SIAP, as measured by SIAP attributes and the correlation within each weapon system.
- Quantify the SDRA's ability to correctly compensate for navigation and sensor position and misalignment errors.
- Document robustness of the PPLI association filter that it does not pass*:*
    - Low-quality PPLIs to the algorithm
    - Unassociated PPLIs
    - PPLIs or local measurement data are ambiguous.

- Determine the effect of DR errors on the SIAP for the purpose of establishing prescribed standards to improve MIL-STD-6016B.
- Document the performance, maximum allowable error (Threshold) for WGS-84 navigation registration by platform.
- Document the performance, maximum allowable error (Threshold) for WGS-84 sensor registration by platform.

2.4.5 Test Methodology

The SDRA test procedures will enable recording of data elements that can be associated to geodetic truth. The test will permit the tracking of a geodetic truth reference through the weapons system to enable analysis that shall determine overall performance and provide quantified data to determine where bias has been induced and corrected within the test participants' data registration process.

To conduct the data registration analysis, data must be collected at specific extraction points. The data extraction points are:

- Ground truth data
- Data link recording (J2.2, J2.3, J2.5, J3.2)
- Weapon System data including Navigation, Sensor, Global track file, and Track reports.

The recording of initialization (emplacement) data will be required to determine what portion of DR is compensated and uncompensated within the weapon system characteristics. The delta to be analyzed is between geodetic truth and the weapon system reported positions.

Time-tagged data is not required but preferred because it aids analysis by time aligning the data elements as the incurred biases are traced and tracked through the weapon system. Time tags are required in order to separate time errors from navigation and sensor registration errors.

To determine the uncertainty of sensor measurement, the following types of weapon system data are required.

- Navigation data of the PRP
- WGS-84 position of PRP
- WGS-84 velocity of PRP, i.e., local level ENU velocity vector
- Attitude vector of PRP orientation relative to (ENU) local level, i.e., roll, pitch, and heading data
- Rate of change of attitude vector of PRP, i.e., roll rate, pitch rate, and heading rate
- Lever arms from PRP to center of sensor aperture and lever-arm between navigation system and PRP (if non-zero).

Sensor Registration uses the same method of analysis as in the general DR critical experiment, plus verification of the technique(s) chosen to compensate for bias errors.

2.4.6 Requisites

To conduct the SDRA experiment and perform the subsequent analysis, the analysis team must plan and the test conductor must ensure that the following requirements are in place to support the experiments.

Recommended flight profiles have been created for previous data registration experiments. The number of aircraft and their distribution is important to a certain extent. For a given sensor, the basic process is to observe blue aircraft, whose PPLIs are available, and use them as tactical ground truth. The ground truth is compared to the radar measurements in the sensor registration filter. If there are no PPLI-capable aircraft in the FOV of a sensor, then no alignment can be carried out.

- Blue aircraft transmitting PPLIs (J2.2)

- Scenario Requisites
  - A minimum of 8 targets with associated PPLI
  - System specific FOV requirements
  - Flight profiles
    - PPLI aircraft sorties that cross, merge and separate, in all three axes with up to 2000 meters of separation

        - Single PPLI aircraft such as AWACS, Joint Surveillance Target Attack Radar System (JSTARS), E-2C, or a Tanker
    - Scenario sizes
    - Positioning and orientation of unit sensors that support mutual tracking. (It is not a requirement that PPLIs be within the FOV all of the time. Levels of registration may be achieved with limited sources in the FOV).
    - Data link architecture that supports maximum connectivity
    - Open pipe
    - Line of Sight (LOS).

- Engineering Builds
    - Sensor Data Registration Algorithm
    - PPLI association algorithm.

2.4.7 Data Reduction and Analysis Method

SDRA analysis will compare, through measurement, the difference between truth and the exercise participants' track position reports and various points that insert or remove bias within the weapon system. The results will be used to document performance as a baseline for subsequent perturbations that are inserted as a result of changes to the sensor and data registration process or the correlation / decorrelation process. The DR MOPs will be associated with the SIAP attributes.

Data collection will be done by each of the Platform's Site Directors.

Data reduction is a JSSEO led process with the System test participants to ensure consistent data formatting and consistent coordinate conversion.

2.4.8 Analysis Team

The analysis team is led by Vern Frederick with primary analytical support by Danny Ellenburg, Greg Watson, and Wayne Altrichter. Results of this critical experiment will be reviewed with the JSSEO Architecture Branch.

2.4.9 Reporting Schedule

A quick-look report will be provided by each analysis team within thirty days after the end of the exercise. The final report will be provided ninety days after the end of the exercise.

2.5 Correlation/Decorrelation ICP Assessment

2.5.1 Experiment Objectives

The objectives of the correlation/decorrelation ICP assessment are:

- Assess the benefit of the implementation of the Automated Local to Remote Correlation – Decorrelation (ALRTC) in MIL-STD 6016B in the Tactical Air Operations Module (TAOM) and UK AWACS.
- Evaluate the effect of various ID difference parameter settings on the SIAP.
- Evaluate the Reported Track Quality (TQ) Correctness and assess its impact on the implemented systems' correlation performance.
- Assess the impact of implementation of the ALRTC by some systems on the SIAP when interoperating with systems without the ALRTC implemented.

The primary analysis of the ALRTC algorithm in MIL-STD-6016B has been done with a constructive simulation (ODDSCAPE) that is driven by truth and link data recorded during live events (ASCIET 00 and JCIET 02). Analysis has shown the relative value of a consistent implementation of the algorithm. The ODDSCAPE analysis was a parametric sensitivity analysis designed to evaluate the default settings of the various correlation tests. The results of the analysis suggest that the current default settings in MIL-STD 6016B for the correlation tests are adequate but that the default correlation restrictions regarding identification differences and Mode 2 Identification Friend or Foe (IFF) conflicts result in suboptimal performance. This analysis was done assuming that all systems implemented the correlation/decorrelation ICP consistently and the size of the JCIET scenario was limited to about 25 airborne objects that were instrumented to provide truth data.

2.5.2 Experiment Hypothesis

Not all systems implement automatic correlation/decorrelation processing, and differences in the methods employed lead to the generation of dual tracks, which degrade warfighting capability. Effective correlation/decorrelation is critical to the SIAP. It is hypothesized that implementation of consistent automatic correlation/decorrelation processing will reduce the incidence of dual tracks while maintaining completeness and improve warfighting capability. Specific hypotheses to be tested in the CJTFEX 04-2 exercise include:

1) Removing the identification difference correlation restriction will increase the rate of correct correlation and not adversely affect the rate of false correlations, thereby improving the SIAP attributes.

2) The performance of the SIAP in a large scenario can be expected to degrade as the correlation problem becomes more complex. Latency effects will likely not be accounted for and will adversely affect track accuracy and the accuracy of reported track quality. This in turn will affect correlation. The number of false correlations can be expected to increase and have a negative effect on the completeness attribute. The number of incorrect non-correlations can increase and have a negative effect on ambiguity.

2.5.3 MOPs and Attributes Measured

Additional Measures of Performance such as, the correct correlation rate, the false correlation rate, correct non-correlations rate (for decorrelation events), the incorrect non-correlation rate (for decorrelation events), and Reported Track Quality Correctness as defined in TR 2001-002, and explained below, can be calculated.

Correct correlation occurs when a Local Track Number (LTN) correlates with a Remote Track Number (RTN) and both the LTN and RTN match to Object A. To compute this MOP, perform the following steps:

1) Determine the total number of correlation events.
2) Count the number of correlation events for which correct correlation occurred, as defined above.
3) Divide step 2 by step 1.

False correlation occurs when a LTN correlates with a RTN and the LTN matches to Object A and the RTN matches to a different object. To compute this MOP, perform the following steps:

1) Determine the total number of correlation events.
2) Count the number of correlation events for which false correlation occurred, as defined above.
3) Divide step 2 by step 1.

Correct non-correlation occurs if the LTN does not correlate with a RTN and LTN matches to object A and no RTN matches object A. To compute this MOP, perform the following steps:

1) Determine the total number of decorrelation events.
2) Count the number of decorrelation events for which correct non-correlation occurred, as defined above.
3) Divide step 2 by step 1.

Incorrect non-correlation occurs if the LTN does not correlate with a RTN and the LTN and any RTN match to Object A. To compute this MOP, perform the following steps:

1) Determine the total number of decorrelation events.
2) Count the number of decorrelation events for which incorrect non-correlation occurred, as defined above.
3) Divide step 2 by step 1.

Reported Track Quality Correctness. Perform the following steps:

1) For each track report, calculate the horizontal positional error.
2) Calculate the TQ associated with the error radius IAW Table 4.4-2, MIL STD 6016B, calling this "Actual TQ".
3) Compare the Reported TQ with the "Actual TQ".
4) Calculate the percentage of times the Reported TQ is less than or equal to the "Actual TQ." One meets the MIL-STD when this percentage is at least 95%.

It is expected if the reported track quality is consistently higher than the actual track quality, that correlation gates will be smaller than they should be and this will reduce the number of correct correlations under MIL-STD 6016B. If reported track quality is consistently smaller than actual track quality, the correlation gates will be larger than necessary to support correct correlation and a greater incidence of false correlations is possible under MIL-STD 6016B. Reported Track Quality Correctness is useful for determining whether Track Quality is being estimated well enough to support MIL-STD 6016B.

SIAP attributes expected to be most affected by the correlation MOPs include the following:

- Completeness. False correlations can result in an incomplete air picture. Correct non-correlations contribute to initiating network tracks in a timely manner improving completeness.
- Clarity. Correct correlations that reduce missed correlations can reduce duals and the number of ambiguous tracks. Incorrect non-correlations will cause a dual to be generated and reduce the clarity of the air picture.
- Commonality
- ID Completeness
- ID Correctness.

2.5.4 Data Management and Success Criteria

Each participant must be operational, able to receive and transmit messages across the network, and successfully records required test data. The truth data must be successfully recorded for the period of time that qualifies the evaluation data as a success. Each participant will record data from the central track stores to include positional, kinematic, identification, IFF/SIF, controlled aircraft status for all tracks, and data link input/output buffers. Each system must identify correlation and decorrelation events.

2.5.5 Test Methodology

The objectives of this experiment only require that the systems be initiated with nominal residual biases. The effect of significant time, navigation, and sensor biases on track accuracies and the correlation process is discussed in the other critical experiments.

2.5.6 Requisites

Requisites include a datalink architecture where units are positioned to provide overlapping sensor coverage to support mutual tracking and maximum connectivity. At a minimum two units must have overlapping coverage. Specific scenario requirements include:

1) Overlapping sensor coverage involving UK E-3 AWACS and USMC TAOC systems with corr/decorr implemented. This means demonstrated interoperability between the two systems such as being able to correlate tracks, appropriately exchange reporting

responsibility, and maintain mutual supporting tracks on tactically significant TSPI equipped aircraft, both those with and without PPLI.

2) Multiple podded aircraft to be mutually tracked.

These operational requirements have been provided to the USJFCOM exercise planners.

2.5.7 Data Reduction and Analysis Method

An initial assessment by each participating platform's analysis team will report the periods of successful data collection for each day based upon the ability to perform the track matching.

The SIAP attributes are calculated for each participant. The Performance Evaluation Tool (PET) shall be used at each site to calculate the SIAP attributes for each participant as a function of time.

Determination of correct and false correlation is done by a cross comparison of the local track to truth matched files.

2.5.8 Analysis Team

The JSSEO analysis team lead for this critical experiment is Jeff Heckel. The UK AWACS lead is John Curtis. Darrell Schultz is the lead for the USMC TAOC. Danny Ellenburg leads the analysis team for PATRIOT.

2.5.9 Reporting Schedule

A quick-look report will be provided by each analysis team within thirty days after the end of the exercise. The final report will be provided ninety days after the end of the exercise.

2.6 JSSEO Block 2 Issue: Network Latency

2.6.1 Experiment Objectives

Characterize latency between transmitting track data from the mission computer to Link-16 and when it first appears on Link-16 (CEC to Link-16) for use in validating network parameters within the JDEP Technical Framework.

2.6.2 Experiment Hypothesis

It is hypothesized that a live exercise can be used to characterize data latencies in its data networks that can be used to validate modeling and simulation testing environments.

2.6.3 MOPs and Attributes Measured

The primary MOPs that will be used will be Initial Track Delay, Message Data Age, and Message Update Interval (UI) as described herein:

1) Initial Track Delay - Time between when a new, firm track is formed in Central Track Stores (CTS) and when the first track message derived from data received by a remote host terminal.

2) Message Data Age - Time between the last radar input to a local track (of Unit A) and when Link 16 track message built from that data is received at a remote host terminal (Unit B).

3) Message UI - Time from one transmission of an object track to the next transmission (update) of the track with the same track number by the same host (one that generates message or one that relays it into link 16 from another link - not paired slot relay) while retaining continuous reporting responsibility (R2) on that object.

2.6.4 Data Management and Success Criteria

Data required included sensor configuration setting, tactical system track files, time-stamped Link-16 data, and truth data.

2.6.5 Test Methodology

Measurement of the initial track delay, message data age, and message UI will be accomplished by extracting link messages utilizing an Air Defense System Integrator (ADSI) and a 2M Joint Tactical Information Distribution System (JTIDS) terminal, and a time synchronized computer to record the results.

2.6.6 Requisites

An ADSI fitted with software for extracting Link-16 time slot numbers associated with each J3.2 message is required for this critical experiment. Also required is a 2M JTIDS terminal and a radio frequency antenna. No special scenario requirements are needed for this critical experiment.

2.6.7 Data Reduction and Analysis Method

Network latency of the Link 16 network will be measured by determining the time slot that contains a given message by using a class 2M terminal along with an ADSI with a slight variant of the standard.

2.6.8 Analysis Team

The analysis lead for the network latency critical experiment is Dave Himelright with technical support provided by Stephen Rhodes.

2.6.9 Reporting Schedule

A quick-look report will be provided by each analysis team within thirty days after the end of the exercise. The final report will be provided ninety days after the end of the exercise.

2.7 Build Coherent Data Library for Integrated Architecture Behavior Model (IABM) Testing/Validation (Including Environmental Effects on Sensors)

2.7.1 Experiment Objectives

Build a library of data from participating sensors to support future validation of sensor and / or IABM performance within the Joint Distributed Engineering Plant (JDEP) Technical Framework in hardware in the loop events including environmental effects on sensors.

2.7.2 Experiment Hypothesis

Sensor database and measurement settings captured during a live event under the same environmental conditions can be used to validate modeling and simulation and stimulate the IABM during performance evaluation.

2.7.3 MOPs and Attributes Measured

Successful data collection will be recorded in a data availability matrix, which will assess the quality of data recorded during the exercise for each sensor.

2.7.4 Data Management and Success Criteria

Data required includes sensor configuration settings and sensor output files. “Raw” sensor data needed includes environmental measures such as air temperature, barometric pressure, relative humidity, etc.

2.7.5 Test Methodology

Record sensor data to obtain clean plots of sensor measurements at the threshold of reporting a track is exceeded and prior to generation of track messages.

2.7.6 Requisites

Overlapping sensor coverage (to the extent possible that is operationally feasible) is required for this critical experiment.

2.7.7 Data Reduction and Analysis Method

Data will be reduced by appropriate System sensor SMEs (as permitted) and provided to the JSSEO IABM test team for test case development.

2.7.8 Analysis Team

The JSSEO lead for this experiment is Maj. Dave Borowsky.

2.7.9 Reporting Schedule

A report concerning the applicability of captured data from the event will be provided within 90 days of the end of the exercise.

2.8 Mobility Rate Measurement

2.8.1 Experiment Objectives

Measure the rate at which location-based group membership is changed due to node movements.

2.8.2 Experiment Hypothesis

The rate at which group membership change occurs for location-based grouping decreases as the geographical area size increases past a threshold size since in a large geographical area most mobile nodes would be covered within the area despite their movements. This is to be observed for mission-oriented applications in which most nodes would be confined within a geographical area even though they might be moving all the time.

2.8.3 Attributes and MOPs Measured

The MOP involved in this experiment is location-based data consistency.

2.8.4 Data Management and Success Criteria

Mobility entries must be populated by all nodes in the exercise regardless of their individual mobility rates/missions. All entries collected by a mobile node must faithfully reflect its actual mobility behaviors in a continuous time space.

2.8.5 Test Methodology

If there is sufficient processing capability (i.e., power and memory) on each device (node), then have each device record its mobility data entries [location, speed, direction] periodically. The period can be 1-10 seconds depending on the capability. For fast-changing devices, a new entry can be created whenever there is a change of speed or direction throughout the exercise. Each device (aircraft, ship, any group force) will collect its own mobility data set for post processing.

If there is not sufficient capability, each device can simply compute its own mobility rate in and out of an area, i.e., number of times the device moves in or moves out of an area over the exercise period. The geographical area can be represented based on the hexagonal coverage model presented in the "Modeling and Analysis of Location-Based Data Consistency Algorithms in Mobile Ad Hoc Networks" report. Each node is assumed to be equipped with GPS so it knows its locations at all times and thus can collect its own mobility data entries [rate, n] for post processing. Here n stands for a geographical area of size n, such that n=1 stands for a geographical area with one hexagon, n=2 containing 7 hexagons, n=3 containing 19 hexagons, etc. Each hexagon can cover a radius of 50-100 meters using the hexagonal coverage model described in the report until the mission area of the exercise is covered. As an example, suppose a node detects (via GPS) that it leaves and enters the geographical area of size 2 (surrounded by 7 hexagons) 10 times within a time period of 100 minutes during the exercise, then one (rate, n) entry to be recorded by the mobile node would be (0.1/minute, 2). Similarly, if it detects that it leaves and enters the geographical area of size 3 (surrounded by 19 hexagons) 5 times within a time period of 100 minutes during the exercise, then one more (rate, n) entry to be recorded by the mobile node would be (0.05/minute, 3). All such entries are to be collected by each mobile node during the exercise for post processing.

2.8.6 Requisites

All nodes equipped with GPS in the exercise will participate in the data collection process.

2.8.7 Data Reduction and Analysis Method

The analysis method will follow the format as described in the "Modeling and Analysis of Location-Based Data Consistency Algorithms in Mobile Ad Hoc Networks" report. The mobility data entries collected will be used to calculate the "aggregate" rate at which membership-change operations occur by all the nodes in the exercise as a function of geographical area size n.

2.8.8 Analysis Team

The analysis team lead is Dr. Ing-Ray Chen, MITRE, of the SIAP Architecture Team.

2.8.9 Reporting Schedule

A quick-look report will be provided by the analysis team within thirty days after the end of the exercise. The final report will be provided ninety days after the end of the exercise.

2.9 Multi-Source Integration (MSI) Measures of Performance (MOP) Evaluation

Recent studies have shown that effective fusion/correlation techniques, algorithms, and technologies have been developed, but there is a lack of commonly accepted quantitative standards for objectively assessing their performance. Development of technical, operational, and interoperability standards for an objective evaluation of fusion/correlation capability is thus of high priority. These standards then can be applied to future assessment of candidate MSI systems.

2.9.1 Objectives

The primary objective of the CJTFEX 04-2 MSI demonstration is to evaluate the usefulness of the latest suite of MSI MOPs by applying them to a variety of different correlation/fusion systems. Secondary goals are the assessment of currently available MSI systems, acquisition of an additional sensor data set and support for MSI involvement in the IABM development.

2.9.2 MSI Plan for IABM Development

Phase one of the MSI test objective was to establish a performance assessment baseline of current MSI technologies under conditions of live-fly data during major battlefield exercises at JCIET 02 and JCIDEX03. The program has since been refocused to provide better support for SIAP IABM development. To accomplish this objective, clear MSI requirement must be established in terms of MSI metrics, assessment methods, and verification and validation (V&V) testing.

2.9.3 MOPs and Attributes Measured

The following MOPs, developed by the JSSEO Metrics Working Group, will be examined in the evaluation conducted at CJTFEX 04-2.

- MSI specific metrics (Correct Intake, Application, Correlation, Usage, and Dual Resolution)
- Track uncertainty measures
- Latencies
- Track Initiation (Input to Output Track Termination)

Other MOPs have been defined but these are unsuitable for application in a live-fly test including:

- Maximum track initiation rate
- Sensor bias
- Distributed operation within integrated architecture
    - MSI to MSI
    - MSI information to the warfighter

Evaluation of these MOPs has been deferred to a later laboratory trial.

All SIAP attributes will be calculated by the Performance Evaluation Tool (PET) and will also be used to analyze MSI performance.

2.9.4 Data Management and Success Criteria

The Government will provide live data feeds for use by participating MSI systems. Figure 1 provides a notional depiction of how event participants will receive feeds from the various sources (e.g., Link-16, Link-11, ASR-11, ASR-9, and TPS-59).

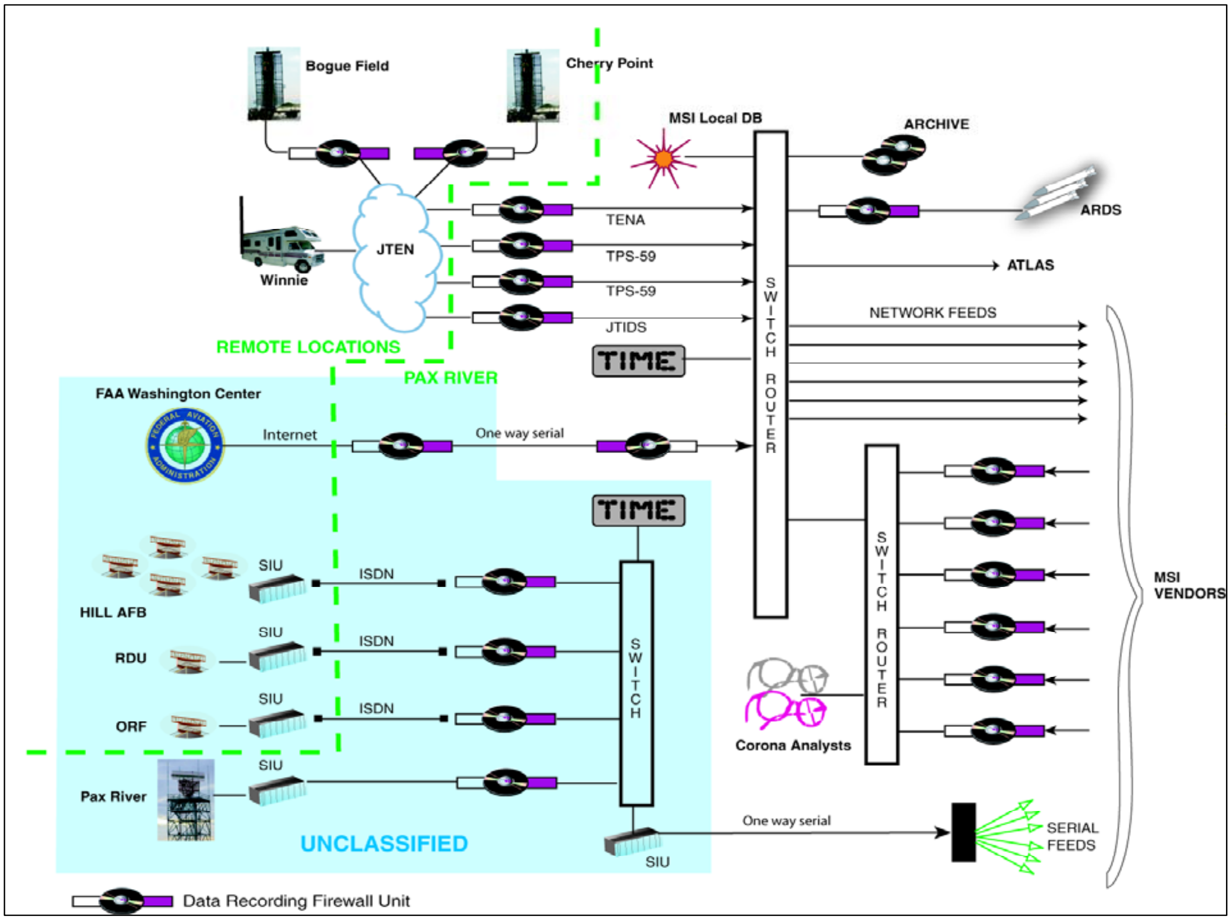

Figure 1. MSI architecture for CJTFEX 04-2

Time synchronization is critical to the MSI demonstration and is key to the analysis process. Network time protocol (NTP) timeserver access will be provided to all participants. Time synchronization will be verified by the technical team from White Sands Missile Range (WSMR) before start of the event.

Watermarking of data actually fed into the MSI system is essential for mapping input measurement data to particular output track(s). The technique adopted is to use fine grain time stamping of each input measurement and incorporation of these within each output record produced by the MSI system. Figure 2 depicts this.

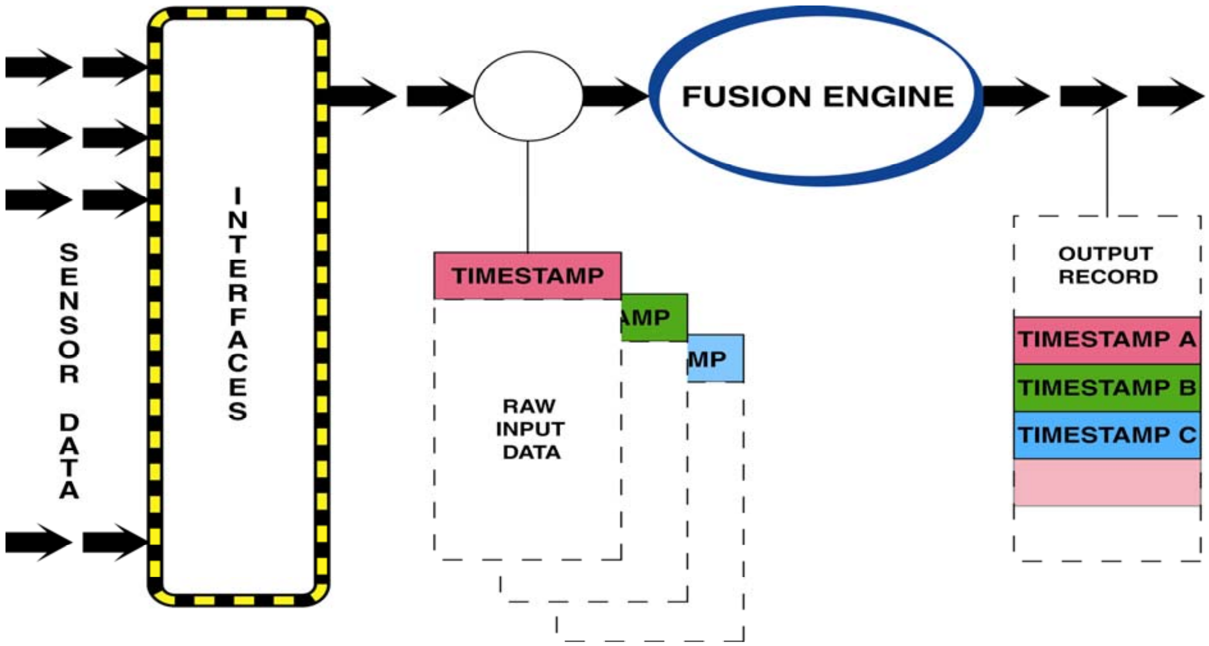

Figure 2. Time stamping the data for the MSI demonstration

The MSI Demonstration will be conducted at the Naval Air Station and Patuxent River. A complete summary of data and instrumentation requirements and data management strategy will be found in the MSI Appendix of the Test Readiness Report (TRR) that will be completed prior to the Test Readiness Review.

2.9.5 Test Methodology

A JSSEO Metrics Sub-Working Group is generating the MOPs for MSI evaluation. Each participant is required to apply these MOPs to their particular system. In parallel a government team will apply these same metrics, for the same time periods, to the output of each system recorded during the exercise. Any substantive difference in the results will need to investigated and explained.

To provide a common baseline for this trial each participant team will be supplied with a set of truth data along with the specific allocation of each sensor measurement to a target or noise point. The teams will also be supplied with sufficient software to calculate the MOPs for their MSI systems. Their experience in this process will also be taken account of.

2.9.6 Requisites

Prior to the CJTFEX 04-2 MSI event, MSI participants will be provided sensor interface configuration documents (ICDs) outlining the format of the data feeds. They will also receive necessary electrical interface descriptions, MSI Data repository download format, the test plan, and a letter of instruction. A representative from the Naval Surface Warfare Center (NSWC), Corona, will review samples of the participant's output data to ensure that it is fully compliant with the issued PET specification.

Sample data feeds will be replayed to the participants in the week preceding the event to allow participants to confirm correct operation of the systems.

2.9.7 Data Reduction and Analysis Method

NSWC Corona is responsible for production of the track-to-truth assignment data sets and deriving values for the MSI MOPS for selected samples of output data from each system.

Attribute computations will be automated through the use of an enhanced Performance Evaluation Tool (PET), incorporating the MSI MOPs. The essential data input fields required for PET tool will be provided in the Test Readiness Report (TRR) MSI Appendix.

MSI system performance partially depends on the quality of the information provided as input. During the event, WSMR will provide Corona a continuous data availability matrix showing the status of all data feeds, and the participating systems. By the end of the exercise Corona will have selected an aggregate of approximately one-hour of data for the subsequent evaluation phase. The criteria for selection of the time periods include:

- Availability of sensor feeds
- Correct operation of all the candidate systems as declared by their on-site teams.
- Traffic patterns of interest
- Density of traffic
- Availability of instrumented data

NSWC Corona will collaborate as needed with MSI participants during the data analysis phase.

2.9.8 Analysis Team

WSMR will record and timestamp the input data feeds and participant output data. NSWC Corona is responsible for data analysis and reporting efforts associated with the MSI Demonstration. Naval Sea Systems Command (NAVSEA) Contracts representatives are serving as the liaison between demonstration participants and the demonstration managers.

2.9.9 Reporting Schedule

After the exercise is completed, each participant will be instructed to analyze about an hour of exercise, the time segments of which will be determined by the MSI team. By the end of August 2004, the reconstructed truth data and the PET program with the MSI MOPs embedded in its code will be provided to the participant. Participants are to evaluate their MSI system and provide a report on their findings, feedback on the applicability and appropriateness of the MSI MOPs, and any other comments about the MOPs to JSSEO by 29 October 2004.

2.10 JITC Track Quality (TQ) Proof of Concept Assessment

2.10.1 Assessment Objective

Continue to refine the track quality (TQ) proof of concept begun at Joint Combat Identification Exercise 2003 (JCIDEX 03) to assess the viability of using exercise data to evaluated systems' TQ performance.

2.10.2 Assessment Hypothesis

Some SIAP systems are not in compliance with MIL-STD 6016C and their system-specific message implementation specifications using both transmitted and host Link-16 data. Additionally, the compliance of the systems participating in the Joint Data Network (JDN) with Chairman, Joint Chiefs of Staff Manual (CJCSM) 6120.01C is under evaluation.

2.10.3 Attributes and MOPs Measured

JITC is responsible for certifying that National Security Systems (NSS) are interoperable in joint and combined environments. Tactical Data Links (TDLs) serve as the backbone for information exchanges among systems contributing to the warfighter's SIAP. CJTFEX 04-2 provides the opportunity to collect and analyze data gathered during this live exercise to supplement the certification process.

Each sensor that reports tracks on the TDL network is required to assign a TQ to that track, sometimes done in the Central Track Stores and not in the sensor computer. TQ is a measure of how accurately that sensor holds that specific track. TQ is measured in cylindrical distance from the point that the system actually reports the track. TQ is measured as numerical value of 0 through 15, which is included in the J3.2, J3.3, and J3.5 (PTI = 1) surveillance messages. The higher the TQ, the more accurately a sensor holds a track and the closer that reported track should be to the center of the cylinder (true position). Standardized reporting of TQ on the link is important to establishing an accurate SIAP because participating systems shift reporting responsibility for any specific track based on this measure. The sensor with the highest TQ should take reporting responsibility (R^2) for that object on the link.

The TQ proof of concept requires the collection of truth data (platforms need to be instrumented to provide the true location of the system), Link 16 data (what TDL participants see on the network), and system data. Time Space Position Information (TSPI) is the truth data reported on the exercise simulation network. The JITC Joint Operational C4I Assessment Team (JOCAT) records Link 16 data and received TSPI data from the simulation network in Defense Interactive Simulation (DIS) format.

2.10.4 Data Management and Success Criteria

TQ computations shall take the following factors into account, as a minimum:

- Design accuracy of the sensor which is tracking the reported track
- Elapsed time since the last sensor update on the reported track
- Most recently calculated velocity of the track
- Own unit's current geodetic position quality as supplied by the Joint Tactical Information Distribution System (JTIDS)/Multifunction Information Distribution System (MIDS) terminal

The TQ proof of concept requires the collection of truth data (E-2C instrumented to provide the true location of the system), Link 16 data (what TDL participants see on the network), and system data as depicted in figure 3. TSPI is the truth data reported on the exercise simulation network. The JITC JOCAT will record Link 16 data and receive TSPI data from the simulation network in DIS format.

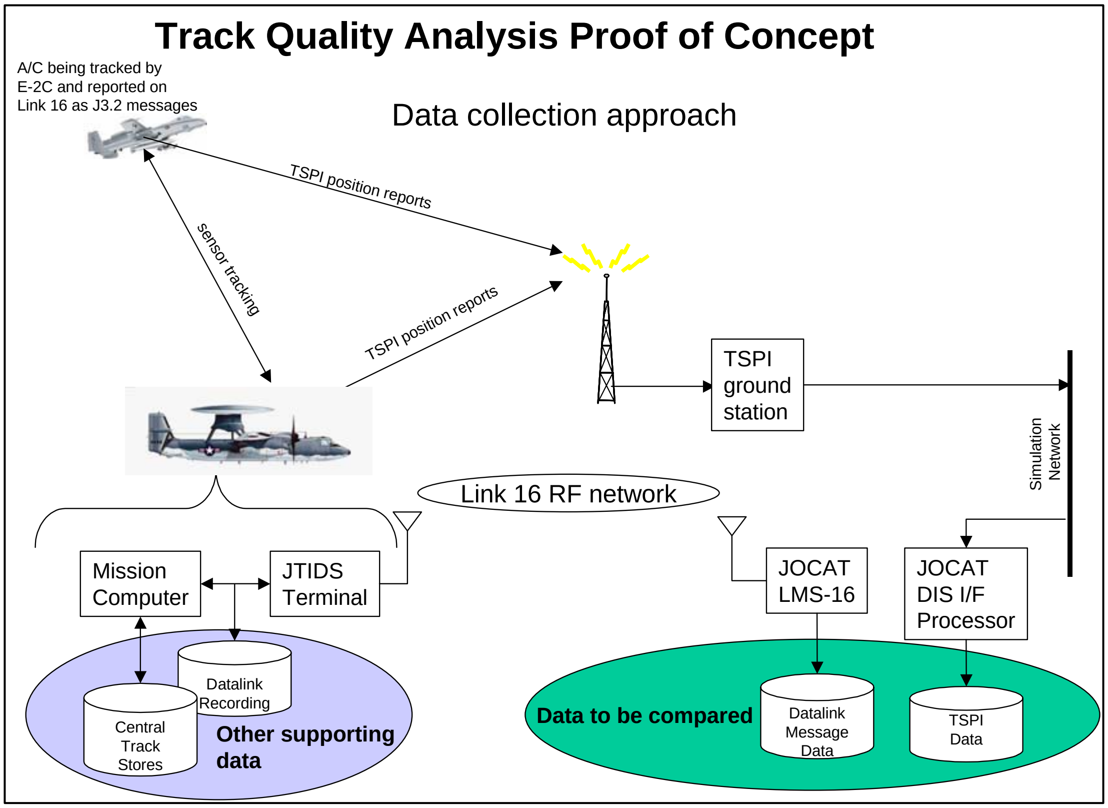

Figure 3. TQ Proof of Concept

2.10.5 Assessment Methodology

The proof of concept requires two steps. The first step compares the TSPI data to the Link 16 data for MIL-STD 6016C TQ conformance. Part of this first step is time-matched TSPI truth tracks to link tracks generated by the selected system.

Since the TSPI and Link 16 data reports were generated at different time intervals, a matching process is required to select the nearest TSPI point in time to a received Link 16 report. Additionally, since the closest reports from these two interfaces do not occur at the exact same time, linear interpolation are used to minimize the error associated with matching a Link 16 report to a TSPI report that is received at a slightly different time. Both interfaces (TSPI and Link 16) will be collected using time synchronized data collection tools to facilitate this matching process.

The second step will be used where the first step results show non-TQ compliance with MIL-STD 6016C. Here we will compare the system's central track stores to the step 1 process to determine the root cause of the non-compliance issues.

2.10.6 Requisites

Data required include data link input/output buffers from E-2C. The current system data dictionary is also required. Preferred system data format is binary, with ASCII as the alternate.

2.10.7 Data Reduction and Analysis Method

Data collection will occur during portions of each five-hour vulnerability period for each day of CJTFEX 04-2. Data reduction and truth track matching will be coordinated with E-2C SMEs.

The process is shown in figure 3 and is summarized below.

1) Collect and record the J3.2 air track messages received by the JOCAT on Link 16 for the respective selected system(s) for specified times coordinated by the SAT.
2) Obtain TSPI data (ground truth) from the SAT for the aircraft being tracked and reported on Link 16 via the J3.2 message by the selected system.
3) Conduct analysis by comparing TSPI data to Link 16 data link.
4) Determine if MIL-STD 6016C criteria are met.
5) If MIL-STD 6016C criteria are met, provide the results.
6) If MIL-STD 6016C criteria have not been met, coordinate with SAT to determine if significant differences exist between system data link recording and data link information received over the air. This may require comparing central track stores from the system to determine root cause. After root cause has been determined, report the results.

2.10.8 Analysis Team

The JOCAT will deploy to Hopper Hall, Dam Neck, Virginia. The team will be lead by John Dugas and consist of ten persons.

2.10.9 Reporting Schedule

Because this is a proof of concept, a formal external report will not be published. Results will be shared with E-2C, JCIET, and the SAT.

2.11 JITC Baseline Information Exchange Assessment

2.11.1 Assessment Objectives

Our support for the SIAP assessment objective (baseline information exchange) as a member of the SAT has the following objectives: baseline information exchange to support the SIAP and SIAP critical experiments. For each assessment objective, we will also determine where the exercise objectives are not supported, to include the operational impact. We will determine:

- Network configuration and the Link 16 architecture's ability to support the required message throughput for the participants and associated missions.
- Systems' ability to exchange required information in order to accomplish their missions.

Our teaming with the SAT and JCIET either directly or indirectly supports analysis of the following Joint Tactical Tasks (JTTs):

- Conduct fire support to include time sensitive targeting (TST) (Tactical (TA) 3.2.1)
- Establish, operate, and maintain baseline information exchange (TA 5.2.1)
- Provide combat identification (CID) (TA 6.5)
- Conduct close air support (CAS) (TA 3.2.2)
- Coordinate battlespace maneuver and integrate with firepower (TA 3.3)
- Conduct joint suppression of enemy air defenses (TA 3.2.4)
- Conduct air-to-air operations (TA 3.2.8)

2.11.2 Assessment Hypothesis

Some SIAP systems are not in compliance with MIL-STD 6016C and their system-specific message implementation specifications using both transmitted and host Link-16 data. Additionally, the compliance of the systems participating in the JDN with CJCSM 6120.01C is under evaluation.

2.11.3 Attributes and MOIs Measured

The foundation of Link 16 interoperability is system's ability to exchange baseline information using required messages. To do this, the system, based on their function, is expected to correctly implement (transmit and receive) messages as prescribed by MIL-STD 6016C. Table 1 provides the measures of interoperability (MOIs) to determine implementation success.

Table 1. Baseline Information Exchange MOIs

Sub-function	MOI Narrative
Message implementation	The system transmits and receives the required message in accordance with (IAW) the military standard (MIL-STD).
No missing messages	The required message is transmitted at the required time.
Proper message sequence	The required messages are transmitted in the proper sequence.
Correct message	The correct message is transmitted.
Complete message content	The message contains all the required data
Correct message content	The message contains correct and accurate data
Message recurrence rate	The system transmits the messages at the required recurrence rate IAW with the MIL-STD, for example every 12 seconds, with a permissible range of every 8 to 20 seconds for its precise participant location and identification (PPLI)

If the system performs the air or ground surveillance function by finding, fixing, and tracking the entity, the MOIs in Table 2 are used to determine the functional success

Table 2. Air and Ground Surveillance Function MOIs

Sub-function	MOI Narrative
Reporting the track	• The system holds the track locally if its track quality (TQ) is less than another system reporting the same track with a higher/better TQ. • The system can correctly report the required track using the J3.2 or J3.5 surveillance message if no other system reports the entity.
Correlation/decorrelation	The locally derived track represents the same object or point as another track, and/or the process of combining two such tracks under one track number.
Reporting responsibility (R^2)	The system with the best positional data on a track transmits track data on Link 16.
Data update request	The system with track R^2 can correctly respond to data update requests.
IFF/SIF management	The system with track R^2 can correctly provide identification friend or foe/selective identification feature (IFF/SIF) to include using information from other systems to do so.
Drop track	The system with R^2 can drop the track selectively or when directed.

If the system performs the space surveillance function by finding, fixing, and tracking the entity and providing the estimated launch and impact points, the MOIs in Table 3 are used to determine the functional success.

Table 3. Space Surveillance Function MOIs

Sub-function	MOI Narrative
Reporting the track, and launch and impact points	• The system holds the track and launch and impact points locally if its track quality (TQ) is less than another system reporting the same track and launch and impact points with a higher/better TQ. • The system can correctly report the required track using the J3.6 message if no other system reports the entity. • The system can correctly report the launch and impact points using the J3.0 message if no other system does so.
Correlation/decorrelation	The locally derived track (and launch and impact

Sub-function	MOI Narrative
	points) represents the same object or point as another track (and launch and impact points), and/or the process of combining two such tracks (and launch and impact points) under one track number.
Reporting responsibility (R^2)	The system with the best positional data on a track transmits track (and launch and impact points) data on Link 16.
Data update request	The system with track R^2 can correctly respond to data update requests.
Covariance	• The system can report the entity's state consisting of its three position coordinates followed by its velocity values. The space surveillance system theater ballistic missile (TBM) surveillance data in the J3.6 surveillance message includes the best estimate of both tracking errors and statistical estimates of bias produced by emplacement, alignment, and other systematic errors. • The transmission of covariance data is required in two cases: - If the R^2 system reports "lost track" in the J3.6 space track surveillance message, the system is required to provide covariance data in the J3.6 message. - If another system sends the J7.1 data update request message to the R^2 system requesting covariance data, the R^2 system is required to provide the covariance data in its next J3.6 update message.
Drop track and launch and impact points	The system with R^2 can drop the space track (and launch and impact points) selectively or when directed.

If the system performs the air-to-air and/or the air-to-ground engagement function, the MOIs in Table 4 are used to determine the functional success. The system might be a command and control (C^2) system, a C^2 airborne system, or a fighter, and is assessed based on its function.

Table 4. Air-to-Air and Air-to Ground Engagement Function MOIs

Sub-function	MOI Narrative
Command	**System B** (a command and control system (C^2)) can correctly send a J9.0 command message to **System A** (an airborne C^2 system) to have one of the fighters under the control of **System A** attack the HOSTILE track.
Mission assignment	**System A** can correctly receive and acknowledge the J9.0 command message from **System B** via the J9.0 message and correctly can direct **a fighter** to engage the HOSTILE track (i.e., **System A's** JTIDS/MIDS terminal provides acknowledgment receipt (machine receipt (MR)) and **System A's** operator provides will comply (WILCO) acknowledgement).
Target sorting	**System A** can correctly direct **a fighter** under its control to engage the track via the J12.0 mission assignment message. **The fighter** can correctly receive and acknowledge the J12.0 mission assignment message from **System A** via the J12.0 to engage the HOSTILE track (i.e., the fighter's JTIDS/MIDS terminal provides acknowledgment receipt (MR) and the fighter's pilot provides WILCO acknowledgement).
Engagement reporting	**The fighter** can report to **System A** its engagement via the J12.6 target sorting message status information. **System A** can correctly receive **the fighter's** J12.6 message. **System A** can correctly report engagement of the HOSTILE track using the J10.2 engagement status message based on **the fighter's** J12.6 message.
Reporting engagement status	**The fighter** can report to **System A** its engagement status via the J12.6 target sorting message status information. **System A** can correctly receive **the fighter's** J12.6 message. **System A** can correctly report the engagement status of the HOSTILE track using the J10.2 engagement status message based on **the fighter's** J12.6 message.
Reporting engagement results	**The fighter** can report to **System A** its engagement results via the J12.6 target sorting message status information. **System A** can correctly receive **the fighter's** J12.6 message. **System A** can correctly report the engagement results of the HOSTILE track using the J10.2 engagement status message based on **the fighter's** J12.6 message.

Sub-function	MOI Narrative
	The fighter can correctly report the decrement of munitions using the J13.2 air platform and system status message.

If the system performs the space engagement function, the MOIs in Table 5 are used to determine the functional success.

Table 5. Space Engagement Function MOIs

Sub-function	MOI Narrative
Engagement reporting	The system can correctly report its engagement using the J10.2 engagement status message.
Reporting engagement status	The system can correctly report its engagement status using the J10.2 engagement status message.
Reporting engagement results	The system can correctly report its engagement results using the J10.2 engagement status message. The system can correctly report the decrement of munitions using the J13.2 air, J13.3 surface, or J13.5 ground platform and system status message.

2.11.4 Data Management and Success Criteria

First, based on the system function and its stated implementation design handbook, MIL-STD 6016C states what messages, associated message words, and respective message word fields the system must transmit and receive.

Second, the JOCAT tool set automatically determines what messages, associated message words, and respective message word fields the system transmits. (Message receipt is currently based on input from the system developers).

Third, the first two are then compared using the baseline information measures of interoperability (MOIs) found in Table 1 and the definitions in Table 6 to provide the results.

Table 6. Baseline Information Exchange Result Definitions

Baseline Information Exchange	
Results	**Result Definition**
Transmission	
(GREEN)	System transmits the message, message words, and message word fields are populated IAW MIL-STD 6016C.
(YELLOW)	System transmits the message, but: • Not all message words are transmitted, • Required message word fields are not populated, • The message word fields are valid values, but are incorrect, providing inaccurate information, and/or, • The message is not transmitted at the required recurrence rate.
(RED)	The system is required to transmit the message, but does not.
NT	The system is not required to transmit the message.
Reception	
(GREEN)	System receives the message, message words, and message words fields are populated IAW MIL-STD 6016C.
(YELLOW)	System receives the message, but: • Not all message words are received, • Required message word fields are not populated, • The message word fields are valid values, but are incorrect, providing inaccurate information, and/or, • The message is not received at the required recurrence rate.
(RED)	The system is required to receive the message, but does not.
NR	The system is not required to receive the message.

The baseline information exchange results and risk assessment serve as the basis to determine how well the system can perform the surveillance function. If the system cannot fully and correctly implement messages such as the J3.2 air and J3.5 ground surveillance message, it will have difficultly successfully performing the surveillance function. The MOIs in Table 3 are used to determine what air and ground surveillance sub-functions the system performs, and Table 7 defines how well they are performed (the results).

Table 7. Air and Ground Surveillance Function Result Definitions

Air and Ground Surveillance Function	
The system's ability to perform each of the following sub-functions to the level defined below: • Report and update the track • Perform correlation/decorrelation, R^2, data update requests, and IFF/SIF management • Drop the track	
Results	**Results Definition**
(GREEN)	Performs the sub-function with no or minor problems.
(YELLOW)	Performs the sub-function, but with moderate problems.
(RED)	Cannot perform the sub-function.

The MOIs in Table 3 are used to determine what space surveillance sub-functions the system performs, and Table 8 defines how well they are performed (the results).

Table 8. Space Surveillance Function Result Definitions

Space Surveillance Function	
The system's ability to perform each of the following sub-functions to the level defined below: • Report and update the track • Report and update the launch and impact points • Perform correlation/decorrelation, R^2, data update requests, and covariance • Drop the track and launch and impact points	
Results	**Results Definition**
(GREEN)	Performs the sub-function with no or minor problems.
(YELLOW)	Performs the sub-function, but with moderate problems.
(RED)	Cannot perform the sub-function.

The MOIs in Tables 4 and 6 are used to determine engagement sub-functions the system performs, and Table 9 below defines how well they are performed (the results).

Table 9. Engagement Function Result Definitions

Engagement Function	
The system's ability to perform each of the following sub-functions to the level defined below: • Report its engagement using the J10.2 engagement status message. • Report its engagement status using the J10.2 engagement status message. • Report its engagement results using the J10.2 engagement status message. • Report the decrement of munitions using the J13.2 air, J13.3 surface, or J13.5 ground platform and system status message.	
Results	**Results Definition**
(GREEN)	Performs the sub-function with no or minor problems.
(YELLOW)	Performs the sub-function, but with moderate problems.
(RED)	Cannot perform the sub-function.

2.11.5 Assessment Methodology

Figure 4 shows the JOCAT process and methodology that will be used to execute JITC's objective. JITC will collect and record the Link-16 radio frequency (RF) network for the daily vulnerability windows. JITC will also collect key documentation identified in Requisites paragraph 2.10.6 for assessment analysis use. Based on the identified inputs, the JOCAT tool set will perform data processing and reduction that will produce automated reports and on-call queries targeted at key potential issues. Analysis will be performed for live, virtual, and constructive (L-V-C) systems.

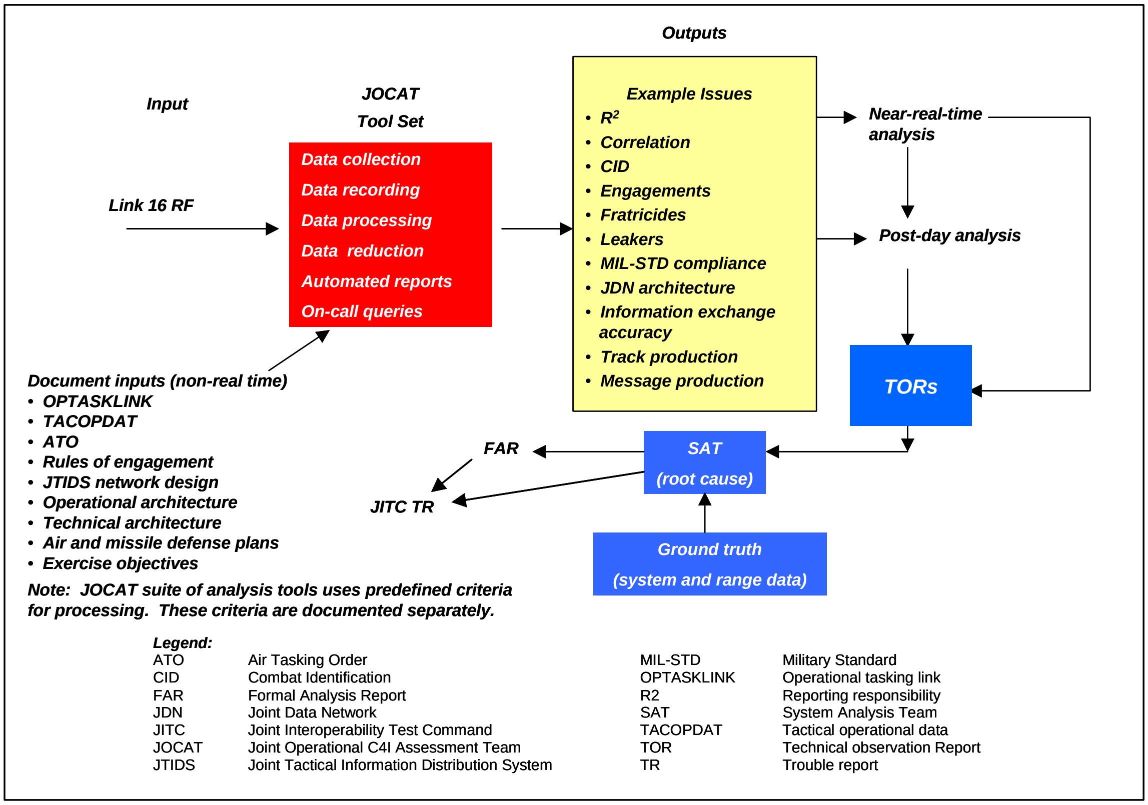

Figure 4. Baseline Information Exchange Methodology

2.11.6 Requisites

Includes operational tasking link (OPTASKLINK), tactical operational data (TACOPDAT), air tasking order (ATO), rules of engagement (ROE), Joint Tactical Information Distribution System (JTIDS) network design, Joint Data Network (JDN) operational and technical architectures, air and missile defense plans, and exercise objectives.

2.11.7 Data Reduction and Analysis Method

See paragraphs 2.10.3 through 2.10.5.

2.11.8 Analysis Team

The JOCAT will deploy to Hopper Hall, Dam Neck, Virginia. The team will be lead by John Dugas and consist of ten persons.

2.11.9 Reporting Schedule

JITC will not publish a report addressing this assessment. Rather it will provide input for the SAT report. Technical observation reports (TORs) will be used to capture results and analysis.

3. Test Schedule

The CJTFEX 04-2 test schedule is provided in Figure 5.

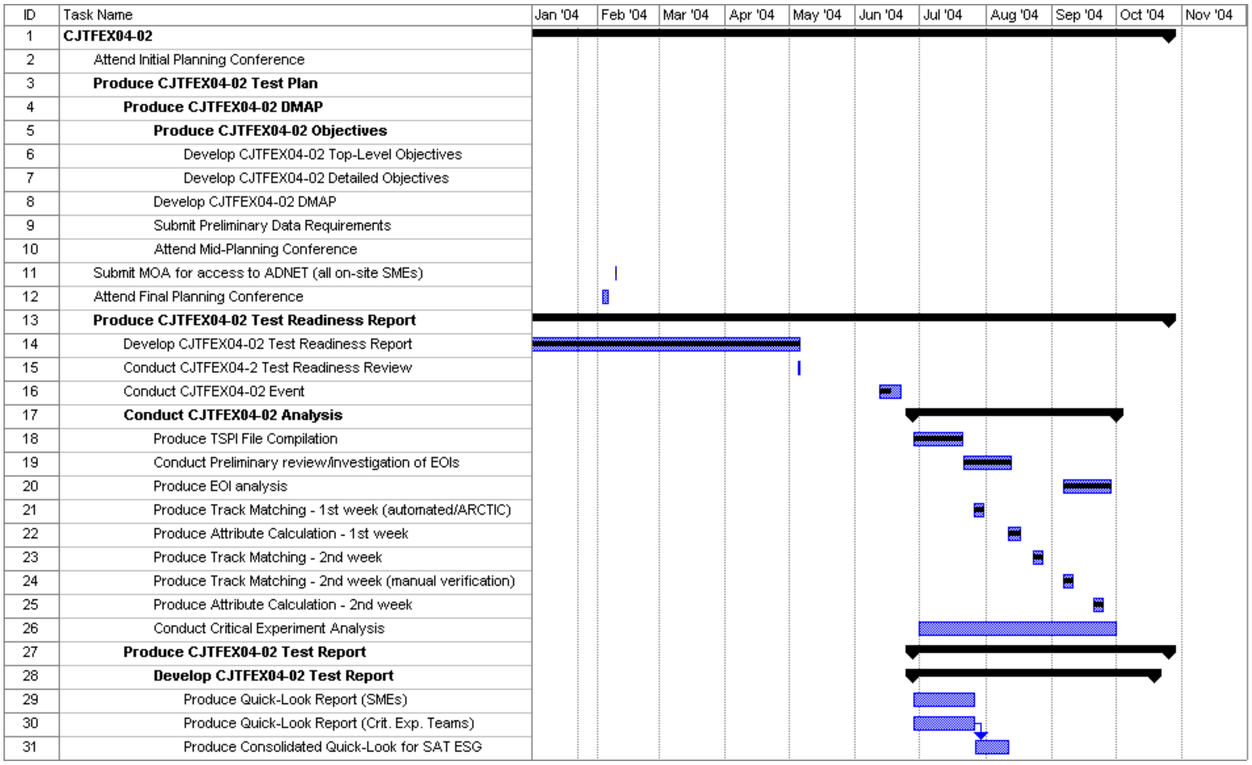

Figure 5. CJTFEX 04-2 Schedule

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4. Test Management and Organization

4.1 Roles and Responsibilities

The roles and responsibilities of each organization are listed in this section to ensure that each organization understands its contribution required for this exercise.

4.1.1 Joint Single Integrated Air Picture System Engineering Organization (JSSEO)

The Joint Single Integrated Air Picture System Engineering Organization (JSSEO), as part of the SIAP Analysis Team (SAT), is a partner with USJFCOM for CJTFEX 04-2 analysis efforts and is responsible for identifying data and analysis requirements needed to support SIAP issues. Together, JSSEO, JITC, JCIET, and other SAT representatives support Integrated Air Defense System (IADS) performance assessments, root-cause analysis, SIAP critical experiment evaluations, lessons learned reporting, SIAP attribute calculations, and test observation report efforts.

4.1.2 United States Joint Forces Command (USJFCOM)

The United States Joint Forces Command (USJFCOM) is the exercise director.

4.1.3 Joint Combat Identification Evaluation Team (JCIET)

The Joint Combat Identification Evaluation Team (JCIET) is responsible for creating and maintaining the CJTFEX 04-2 Data Management Plan (DMP) that covers all analysis activities for CJTFEX 04-2, including the SIAP evaluation, critical experiments, and MSI demonstration. This plan covers all data requirements, identifies responsibility for data collection and is a tool to accomplish the needed data distribution. JCIET will capture those data items identified in the DMP as being JCIET's responsibility.

As part of the SAT, JCIET will support root cause analysis on CID related SIAP deficiencies. JCIET will participate in the capturing of events-of-interest (EOIs)and ensure that they are included in the JSSEO LLKB as TORs.

4.1.4 Joint Interoperability Test Command (JITC)

The Joint Interoperability Test Command (JITC) will continue its support to USJFCOM, teaming with JCIET and JSSEO, to determine the health and improvement of the SIAP during USJFCOM events/exercises/experiments, and to assess system compliance to MIL-STD 6016C and CJCSM 6120.01C.

JITC will also:

– Team with JCIET to perform an assessment of the consolidated ground picture (CGP).
– Perform an evaluation of theater missile defense (TBM) defense.
– Lead the virtual and constructive (V-C) systems' Link 16 risk assessment.
– Support analysis of specific EOIs identified to JITC during CJTFEX 04-2.

Finally, representatives from JITC, as a member of the SAT, will support root-cause analysis of identified SIAP deficiencies.

4.1.5 Participating Service(s)

Integrated Air Defense Systems (IADS) from all Services will be participating in this event, including (but not limited to) PATRIOT, AEGIS (which includes CEC), TAOC, E-2C, and AWACS. Additionally, several Royal Navy ships and UK AWACS will participate in the exercise. Services are responsible for coordinating with the SAT for planning on-site event execution and post-event analysis for CJTFEX 04-2. Service SMEs participating in the critical experiments and analysis are responsible for providing a quick-look report of activities 30 days after the end of the exercise, and a final report within 90 days.

4.1.6 Supporting Agencies for the SIAP Assessment

Supporting agencies such as NSWC Corona, the Center for Naval Analyses (CNA), NSWC Dahlgren, and Capabilities and Limitations (NSWC Port Hueneme):

- Ensure that the test(s) accurately capture program attributes
- Provide on-site analysis, as necessary.

CNA is responsible for computing the SIAP attributes upon completion of data collection by JCIET. Data is expected to be available to CNA for analysis within 30 days after the conclusion of the exercise.

4.1.7 Supporting Agencies for the MSI Demonstration

For the MSI Demonstration, White Sands Missile Range (WSMR) will be the Technical Lead and is responsible for all data collection, reduction, and storage efforts for the MSI Demonstration. WSMR will record the input data feeds and participant output data. WSMR is responsible for providing NSWC Corona the data availability matrix and the PET formatted input data. Prior to

the event, WSMR is responsible for providing each participant and NSWC Corona interface configuration documents and sample data as available to help participants prepare for the demonstration. WSMR will be responsible for maintaining data collection logs that identify data collection times, network and system anomalies, and other applicable comments.

Corona is responsible for determining an hour of analytical segment(s) that will be used for the JSSEO MSI metrics evaluation. Corona will reconstruct the air picture and conduct truth-to-track matching of the segment(s). By the end of August 2004, Corona will deliver to the participants their truth-to track matching for each participant to use. If deemed necessary by JSSEO, Corona will conduct an independent analysis of participant MSI MOP results and provide them to JSSEO within thirty days of tasking.

NAVSEA Contracts' role for the MSI Demonstration is to serve as the liaison between demonstration participants and the demonstration managers. NAVSEA Contracts' role is to develop and post the Request for Proposal (RFP) for Industry participation, facilitate technical review of proposals, and conduct contract award for participation. They ensure procedures are followed to protect participants' proprietary interests and to ensure the Government's interests are protected as well.

4.1.8 SIAP Analysis Team: ESG and Other Test Representatives

Representatives from the SAT will augment the JCIET and JITC efforts. Specifically, the SAT provides subject matter experts to lead the IADS performance assessments, root-cause analysis, SIAP critical experiment evaluations, lessons learned reporting, compliance analysis, and test observation report efforts. Additionally, the SAT will be responsible for coordinating necessary recommendations regarding system interoperability certification. SAT subject matter experts are responsible for providing JSSEO quick-look report within thirty days of the event containing a summary of events of interest analysis (completed) and a prioritized list of events of interest that warrant further analysis.

The SAT Executive Steering Group (ESG) is responsible for reviewing the findings of the SAT and the report provided by CNA with the SIAP attributes and root-cause analysis results.

4.2 On-site Organization

The SAT on-site management team is responsible for the overall execution of the Test Observation Report (TOR) process in support of the analytical objectives specified in this test plan. The management team will be led by Mr. Mark Davis, PEO ASMD/BAE Systems, On-site SAT Team Leader. The management team will comprise system SMEs representing each of the air

defense-related BLUFOR CJTFEX 04-2 participant systems. The SAT Team will also include joint IADS analysis experts. The On-site SAT Team Leader will provide periodic status updates of SAT activities to the JCIET liaison to the SAT, Dr. Jeff Lutz, and the CJTFEX 04-2 JSSEO Test and Evaluation lead, LCDR Paul Ghyzel.

The core of the SIAP on-site analysis team will be composed of the Service and system SMEs possessing the data collection/reduction/monitoring and analysis tools necessary to accomplish the objectives specified in this plan. The primary responsibility of SAT system SMEs is to perform root cause analysis of TORs associated with the tactical systems they represent. Location of participants during CJTFEX 04-2 execution and the lead SMEs for each System is listed in Appendix C.

The SAT will be located at Hopper Hall, NSWC Dam Neck Combat Direction Systems Activity (CDSA) for the duration of the exercise. The tentative SAT layout for Hopper Hall is provided in Figure 6. Air Force representatives will be located at Shaw AFB. NSWC Corona will represent AEGIS.

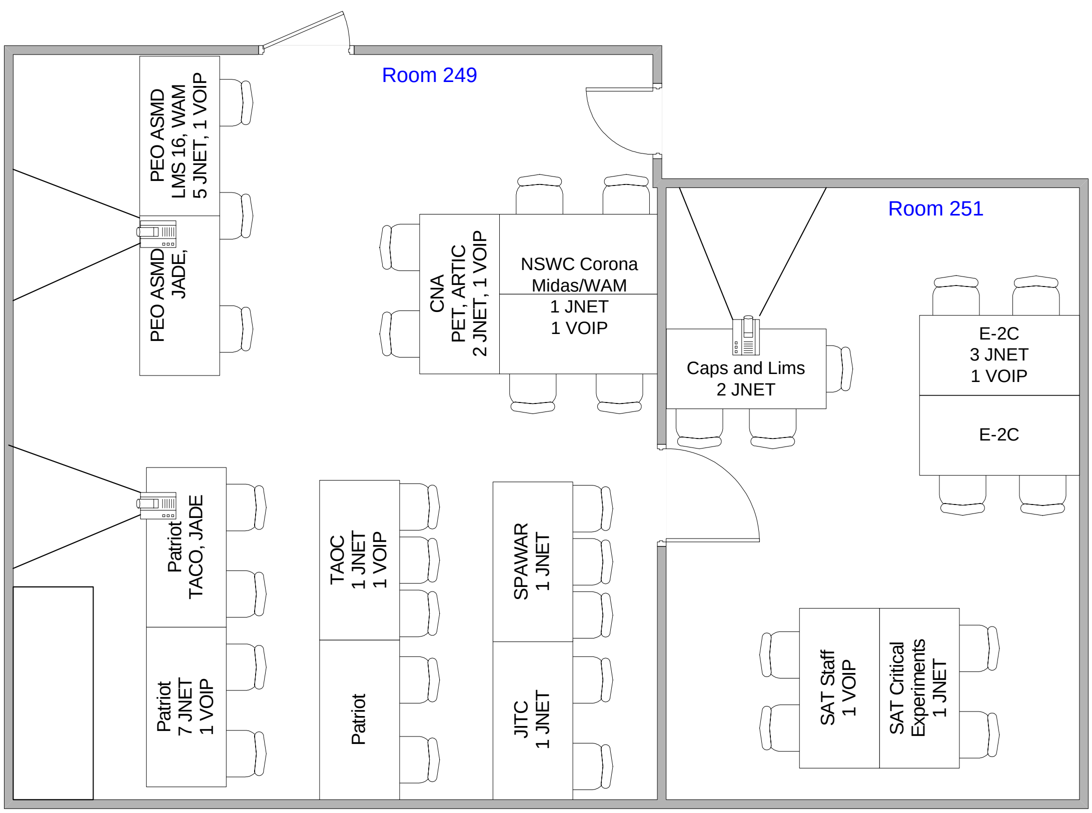

Figure 6. SAT Layout at Hopper Hall

5. REPORTING

5.1 Test Readiness Report

The Test Readiness Report (TRR) for this event will update this Test Plan and provide greater detail. The TRR will be presented to the designated approval authorities at the Test Readiness Review. The Test Readiness Review will accomplish the following: 1) review in greater detail the test objectives, methods, data collection and analysis plan, individuals' roles and responsibilities, and Go/No-Go criteria, and 2) provide evidence to the approval authorities that all preparations for the event are complete and the event can be completed with a high likelihood of success. Approval signature on the TRR indicates agreement with the report and authorization to conduct the test.

5.2 Quick-Look Report

Quick-look reports shall be submitted to JSSEO within 30 calendar days of completing the test event. Following the test event, each organization submitting a quick-look report should report their preliminary findings as they relate to the test objectives. Any additional findings of significance, especially as they relate to the SIAP attributes, should also be reported upon completion. Preliminary conclusions and recommendations as they relate to the test objectives should be included as appropriate.

5.3 Technical Report Development

A technical report will be generated within 90 days following the CJTFEX 04-2 event. Table 10 provides the planned schedule for the reporting process.

Table 10. Reporting Timeline Requirements

Description	**Responsible Party(ies)**	**Date**
Quick-look report	SAT SMEs	26 July 2004
Quick-look release for comments	JSSEO	11 August 2004
Final Reports submitted	SAT SMEs/CE Teams	21 September 2004
Final Report review / comment	SAT SMEs/SAT ESG	7 October 2004
Final TR signed	JSSEO	25 October 2004

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6. REFERENCES

JSSEO Technical Report 2003-029: Single Integrated Air Picture (SIAP) Attributes Ver. 2.0, (2003, August). Arlington, VA: JSSEO.

SIAP SE TF Technical Report 2001-003: Single Integrated Air Picture (SIAP) Metrics Implementation, (2001, October). Arlington, VA: JSSEO.

Combat Identification Capstone Requirements Document (CID CRD), (2001) U.S. Joint Forces Command.

Theater Air and Missile Defense Capstone Requirements Document (TAMD CRD). (2003 revision, March draft).

MIL-STD-6016C: Tactical Digital Information Link (TADIL) J Message Standard. (2003, August 1). U.S. Department of Defense.

CJCSM 6120.01C: *Joint Multi-Tactical Data Link (TDL) Operating Procedures.* (2002, August 1). *Chairman, Joint Chiefs of Staff Manual.* U.S. Department of Defense.

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APPENDIX A: ACRONYMS

ADSI	Air Defense System Integrator
ALRTC	Automated Local to Remote Correlation – Decorrelation
ARCTIC	Automated Reconstruction and Correlation Tool for Interoperability Characterization
ASCII	American Standard Code for Information Interchange
ATO	Air Tasking Order
BLUFOR	Blue Force(s)
C2	Command and Control
C4I	Command, Control, Communications, Computers, & Intelligence
CAS	Close Air Support
CDSA	Combat Direction Systems Activity
CE	Critical Experiment
CEC	Cooperative Engagement Capability
CGP	Consolidated Ground Picture
CID	Combat Identification
CID CRD	Combat Identification Capstone Requirements Document
CJCSM	Chairman, Joint Chiefs of Staff Manual
CJTFEX	Combined Joint Task Force Exercise
CNA	Center for Naval Analyses
CRD	Capstone Requirements Document
CRS	Common Reference Scenario
CRSD	Common Reference Scenario Driver
DIS	Distributed Interactive Simulation
DMAP	Data Management and Analysis Plan
DMP	Data Management Plan
DR	Data Registration
DX	Data Extraction
ENU	East-North Up
EOI	Event of Interest
ESG	Executive Steering Group
ESTEL	E-2C Systems Test and Evaluation Laboratory
FoS	Family of Systems
FOV	Field of View
GPQ	Geodetic Position Quality
GPS	Global Positioning System

HWIL	Hardware-in-the-Loop
IABM	Integrated Architecture Behavior Model
IADS	Integrated Air Defense System
IAW	In Accordance With
ICD	Interface Configuration Document
ICP	Interface Change Proposal
ID	Identification
IFF	Identification Friend or Foe
JADE	Joint Analysis Display Environment
JCHE	Joint Combined Hardware-in-the-Loop Event
JCIDEX	Joint Combat Identification Exercise
JCIET	Joint Combat Identification Evaluation Team
JDEP	Joint Distributed Engineering Plant
JDN	Joint Data Network
JGPSCE	Joint Global Positioning System Combat Effectiveness
JITC	Joint Interoperability Test Command
JMACA	Joint Methodology to Assess C4ISR Architecture
JOCAT	Joint Operational C4I Assessment Team
JSSEO	Joint SIAP System Engineering Organization
JSTARS	Joint Surveillance Target Attack Radar
JT&E	Joint Test and Evaluation
JTIDS	Joint Tactical Information Distribution System
JTT	Joint Tactical Tasks
JU	JTIDS Unit
LLKB	Lessons Learned Knowledge Base
LMS	Link Monitoring System
LOS	Line of Sight
LTPO	Lower Tier Project Office
L-V-C	Live-Virtual-Constructive
MIDS	Multifunction Information Distribution System
MIL STD	Military Standard
MOA	Memorandum of Agreement
MOP	Measure of Performance
MCSC	Marine Corps Systems Command
MOI	Measure of Interoperability
MSI	Multi-Source Integration
NAVAIR	Naval Air Systems Command
NAVSEA	Naval Sea Systems Command
NSWC	Naval Surface Warfare Center
NTP	Network Time Protocol

OSD	Office of the Secretary of Defense
PC	Personal Computer
PET	Performance Evaluation Tool
PPLI	Precise Participant Location and Identification
PRP	Platform Reference Point
R2	Reporting Responsibility
RF	Radio Frequency
RFP	Request for Proposal
ROE	Rule(s) of Engagement
RTN	Remote Track Number
SAT	Single Integrated Air Picture Analysis Team
SDRA	Sensor Data Registration Algorithm
SE	System Engineer
SPAWAR	Space and Naval Warfare Systems Command
SIAP	Single Integrated Air Picture
SIF	Selective Identification Feature
SIPRNET	Secret Internet Protocol Router Network
SME	Subject Matter Expert
TA	Tactical
TACO	Tactical Operations
TAMD	Theater Air and Missile Defense
TAOC	Tactical Air Operations Center
TBM	Theater Ballistic Missile
TD	Test Director
TDL	Tactical Data Link
TEMP	
TF	Task Force
TIM	Terminal Input Message
TOM	Terminal Output Message
TOR	Test Observation Report
TPWG	Test Plan Working Group
TQ	Track Quality
TR	Technical Report
TRAP	Tactical Related Applications
TRR	Test Readiness Report
TSIU	Tactical System Interface Unit
TSPI	Time Space Positioning Information
TST	Time Sensitive Targeting
TUT	Targets Under Trees
UK	United Kingdom

USJFCOM	United States Joint Forces Command
USMC	United States Marine Corps
V&C	Virtual and Constructive
V&V	Verification and Validation
VOIP	Voice Over Internet Protocol
WAM	Warfare Analysis Model
WG	Working Group
WSMR	White Sands Missile Range

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APPENDIX B: SIAP METRICS

The Joint Single Integrated Air Picture System Engineering Organization (JSSEO) developed a set of attributes (SIAP System Engineering Task Force, Technical Report 2003-029 Version 2.0, August 2003) derived from TAMD and CID CRD key performance parameters. For reference, the qualitative definitions of the SIAP attributes are provided as follows:

Completeness: The measure of the portion of true air objects that are included in the SIAP. The air picture is complete when all objects are detected, tracked and reported.

Clarity: The measure of the portion of the SIAP that contains ambiguous tracks and/or spurious tracks. The air picture is clear when it does not include ambiguous or spurious tracks.

Continuity: The measure of how accurately the SIAP maintains track numbers over time. The air picture is continuous when the track number assigned to an object does not change.

Kinematic Accuracy: The measure of how accurately the TAMD Family of Systems (FoS) reports track position and velocity. The air picture is kinematically accurate when the position and velocity of each assigned track agree with the position and velocity of the associated object.

ID Completeness: The measure of the portion of tracked objects that are in an identified state. The ID is complete when all tracked objects are in an identified state.

ID Correctness: The measure of the portion of tracked objects that are in the correct ID state. The ID is correct when all tracked objects are in the correct ID state.

ID Clarity: The measure of the portion of tracked objects that are unambiguously identified. The ID is clear if no tracked object is in the ambiguous ID state.

Commonality: The measure of consistency of the air picture held by TAMD FoS participants. The air picture is common when the assigned tracks held by each participant have the same track number, position, and ID.

For CJTFEX 04-2, all SIAP Attributes will be computed and provided in the final report for USJFCOM. Particular relevance of the attributes in each critical experiment was addressed in Section 2. Attribute computations will be automated through the use of the Performance Evaluation Tool (PET), into which the algorithms for the SIAP attributes have been encoded.

APPENDIX C: POINTS OF CONTACT

Table C-1. CJTFEX 04-2 Planning and Execution Participants

Name	Organization	Role	Telephone Number (COMM) (DSN)	E-mail (UNCLASSIFIED) (SIPRNET)
Steve Karoly	JSSEO	SAT ESG Chair	(703) 602-6441 x204	Steve.karoly@siap.pentagon.mil
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Dale Whitehead	JSSEO/SPA	Test Planner	(703) 600-1807	dwhitehead@spa.com
Christy DeHaven	JSSEO/NG	Logistics	(540) 663-9730	Christy.Dehaven@ngc.com
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Rich Clarke	JITC	JITC Oversight	(520) 538-5027	clarker@fhu.disa.mil
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Mary Rock	PMA231/ ESTEL/A1-ES	E-2C SME	301-995-3909	rockmf@navair.navy.mil
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